
Chapter 2: Engineering the Meridian 1 for Meridian Link and CCR applications

In engineering a Meridian 1 system for the Meridian Link or CCR application, you are basically finding the answers to four questions:

- Does the Meridian 1 system have enough capacity to be able to handle the traffic added by the new application? Which Meridian 1 option best meets the requirements?

To be able to answer these questions you must know or calculate the current spare capacity of your Meridian 1 system and the capacity required to handle the added traffic.

- How many additional music and recorded announcement (RAN) ports are required?

Both CCR and Meridian Link applications require music ports but only CCR requires RAN ports.

- How many additional Meridian Mail ports are required to handle related Interactive Voice Response (IVR) or Host Enhanced Voice Processing (HEVP) applications?

Meridian Mail ports may be required for the Hold-in-Queue-for-IVR feature of CCR or for the HEVP feature of the Meridian Link application.

- What data rate is required for the data link between the Meridian Link module and the host computer (the Host Link or the Meridian Link)? (Note that the AML is set to 19.2 kbps for both Meridian Link and CCR.)

This chapter provides procedures to enable you to answer these questions. For more information about engineering a Meridian 1 system, refer to the *Meridian 1 System Planning and Engineering Guide* (P0744197).

Engineering the Meridian 1 capacity

The recommended engineering level of a Meridian 1 system is called rated capacity; at that traffic level, all grades of service requirements are met. The *rated capacity* of a Meridian 1 system is the theoretical maximum number of calls that the system could handle in one hour. The rated capacity is the number of calls the system can handle in 0.7 hours (2520 seconds). The rated capacity leaves a reserve of 30% to accommodate peaks in the traffic during the busiest hour (so that the service will not deteriorate during these peaks).

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The rated capacity depends on the type of CPU (NT, XT, Option 11, Option 81, and so on), and the types and numbers of features installed. However, if you know the rated capacity for one type of system, you can easily find the rated capacity for another type of system with the same configuration of features. This is useful, for example, if the Meridian Configurator does not compute the capacity of your CPU type.

In Table 1, the capacity of other CPUs are rated against the Option 81 CPU, which is assumed to have a relative rated capacity of one. The same configuration of features is assumed for all CPUs, and also that all CPUs are serving software with similar features and applications.

Table 1
Relative CPU real-time capacity among Meridian 1 Options

Meridian 1 system	Relative real-time capacity
Option 51C/61C/81C (CP2)	1.57
Option 11C	1.17
Option 51C/61C/81C (CP1)	1
Option 81	1
Option 51/61/71 (Omega CPU)	.47
Option 21E (Storme CPU)	.38
Option 21 (Gemini CPU)	.12
XT/NT (Omega CPU)	.47
ST (Gemini CPU)	.12
Option 11E	.18

The “C” version of options became available with Release 21. The Option 11C has a processor similar to that of the CP2 (with different clock speed) which is the reason why it is so much more powerful than the Option 11E. The CP1 processor is the same as the processor used for the Option 81.

So, for example, if you know that the rated capacity of an Option 81 system with a certain configuration of features is 30,000 calls per hour, you can calculate that the rated capacity of an NT system with the same configuration is (30,000 x 0.47) or 14,100 calls per hour.

The capacity is usually expressed in terms of *Equivalent Basic Calls* (EBC) per busy hour. An EBC is an internal, unfeatured call from one 2500 telephone set to another, and represents the simplest type of call in regard to call setup and tear-down.

Determining the Meridian 1 capacity

The following procedure describes how to use the Meridian Configurator to calculate the real-time capacity of your Meridian 1 system. If the Meridian Configurator does not handle your processor type (for example, if you have an NT or XT processor), calculate the capacity of an Option 81 system with the same configuration as yours. Then use the relative real-time capacity from Table 1 to calculate the capacity of your system.

If you cannot use the Meridian Configurator, or if it is not supported in your market, refer to

- Appendix A, which contains a quick guide for determining the Meridian 1 call center capacity
- Appendix B, which contains procedures for engineering Meridian 1 network loop capacity for call centers
- Appendix C, which contains procedures for engineering the Meridian 1 CPU capacity
- Appendix D, which contains procedures for engineering the CCR system

You should be aware that Appendix A is the least accurate method for determining Meridian 1 capacity, and that the formulas used in Appendix C are simpler than those used by the Meridian Configurator and consequently provide results that are not as accurate as the results provided by the Meridian Configurator.

The following procedure outlines how to fill out Table 2, and assumes that you know how to use the Meridian Configurator. Refer to the *Meridian Configurator User's Guide* (NTP 004-0021-315) for the identity of each input field.

- 1 Enter the type and number of lines, the expected holding times, and the traffic in centicall-seconds (CCS).
- 2 To account for real-time impact, enter the number and type of trunks and the traffic in CCS.
- 3 Enter all software options to be configured, including Meridian Mail.

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- 4 Enter
 - the number of ACD agents and trunks
 - the number of recorded announcement (RAN) trunks and music ports
 - the number of local ACD agents receiving inbound calls that are queued to local ACD DNs
 - CCS
 - holding times
 - average seconds to answer
 - 5 Enter the number of ACD and non-ACD lines to be assigned as associate sets (AST). This number includes
 - any ACD agent lines for which the Meridian Link application reports call information (such as ANI/CLID or DNIS information on incoming calls)
 - any lines connected to IVR, Voice Response Unit (VRU), or autodialer ports
 - any non-ACD set to be controlled or monitored by the Meridian Link application
 - 6 Enter the percentage of lines to be assigned as AST that will be configured for Meridian Link status messages. This includes non-ACD sets to be controlled by the Meridian Link application.
 - 7 Enter the percentage of incoming calls to be routed by an application using CCR or Host Enhanced Routing on the Meridian Link application. This includes any ACD or non-ACD calls to receive routing treatment. It does not include incoming traffic terminated normally.
 - 8 Enter the number of ACD agents placing outbound calls by previewing customer telephone numbers using a Meridian Link-based application. Enter CCS and holding time.
 - 9 Enter the number of ACD agents placing outbound calls using a Meridian Link-based application with third-party autodialers. Enter CCS and holding time.

- 1 0** Enter the number of autodialing ports associated with a Meridian Link-based predictive-dialing application. A predictive-dialing application predicts when an agent will become available and makes a call based on that prediction. Enter also the CCS, holding time, and the percentage of calls that will be transferred.
- 1 1** Enter the number of third-party voice-response ports that will receive inbound ACD calls. Enter the CCS, holding time, and percentage of calls to be transferred to a live agent. These numbers should be entered even if the voice ports will not be controlled by a CCR-based or Meridian Link-based application.
- 1 2** Enter the number of Meridian Mail ports required to support a Meridian Link-based application using Host Enhanced Voice Processing (HEVP). HEVP allows a host-computer application to answer a call and prompt the caller to enter information.

Table 2
Meridian 1 capacity worksheet

1	Number of lines	
	Type of line	
	Expected holding time	
	Traffic (CCS)	
2	Number of trunks	
	Type of trunk	
	Traffic (CCS)	
3	Software options to be configured • _____ • _____ • _____ • _____	
4	Number of ACD agents	
	Number of trunks	
	Number of RAN trunks	
	Number of music ports	
	Number of local ACD agents receiving inbound calls queued to local ACD DNs	
	Traffic (CCS)	
	Holding time	
	Average time to answer (seconds)	
5	Lines to be assigned as AST	
6	Percentage of AST lines (item 5) to be configured for Meridian Link status messages	
— continued —		

Table 2
Meridian 1 capacity worksheet, continued

7	Percentage of incoming calls to be routed by an application using CCR or Host Enhanced Routing (HER) on Meridian Link (does not include incoming traffic terminated normally)	
8	Number of ACD agents placing outbound calls by previewing customer telephone numbers using a Meridian Link-based application	
	Traffic (CCS)	
	Holding time	
9	Number of ACD agents placing outbound calls using a Meridian Link-based application with third party autodialers	
	Traffic (CCS)	
	Holding time	
10	Number of autodialing ports associated with a Meridian Link-based predictive-dialing application	
	Traffic (CCS)	
	Holding time	
	Percentage of calls that will be transferred	
11	Number of third party voice-response ports that will receive inbound calls	
	Traffic (CCS)	
	Holding time	
	Percentage of calls that will be transferred to a live agent	
12	Number of Meridian Mail ports required for a Meridian Link-based application using HEVP	

Engineering Meridian Mail and IVR ports

The CCR and Meridian Link applications both provide access to voice prompting and processing. CCR has a Hold-In-Queue-for-IVR feature that enables calls to be held in a queue for subsequent access to interactive voice processing. The Meridian Link application has a Host Enhanced Voice Processing (HEVP) option that allows a host-computer application to use voice prompting and processing.

Determining Meridian Mail port requirements for the Hold-in-Queue-for-IVR feature

- 1 Using the number of calls for the busiest hour of the year, estimate the number that will receive voice processing. For example, if a call center receives 5000 calls, half of which require voice processing, this number will be 2500.
- 2 Estimate the average holding time for the calls that will receive voice processing for the busiest hour of the year.
- 3 Calculate the total traffic in CCS.
$$\text{CCS} = \text{calls receiving voice processing} \times \text{holding time}/100$$

For example, if a call center receives 2500 calls requiring voice processing, and the average holding time before the call transfers to an agent is 40 seconds, the CCS = $(2500 \times 40)/100 = 1000$.
- 4 Determine the maximum traffic already on the Meridian Mail system during the busiest hour. (Use Meridian MAX reports on traffic through Meridian Mail agents or the Meridian Mail Voice Service Summary Report.)
- 5 Determine the traffic from both voice messaging and call center at the call center busiest hour.
- 6 If the busiest hour for the call center differs from that for Meridian Mail, estimate the traffic from the call center for Meridian Mail's busiest hour. Then estimate the combined traffic on Meridian Mail.
- 7 Using the greater of the results from steps 5 and 6, use Table 4 to estimate the number of ports required. Subtract the number of ports already installed to obtain the number of additional ports required.

Table 3
Worksheet for determining Meridian Mail ports for Hold in Queue for IVR

1	Number of calls receiving voice processing in the call center's busiest hour	(a)
2	Average holding time for calls in step 1	(b)
3	Traffic (CCS) = (a) x (b) / 100	(c)
4	Existing Meridian Mail traffic during call center busiest hour	(d)
5	Total traffic = (c) + (d)	(e)
6	If the busiest hour for the call center is different from the busiest hour for Meridian Mail, repeat steps 1–5 for the Meridian Mail busiest hour. Total traffic	(f)
7	Using the greater of (e) and (f), find the number of ports in Table 4. Required ports	(g)
8	Existing ports Additional ports = (g) - (h)	(h)

Table 4
Meridian Mail port capacity

Ports	4	8	12	16	20	24	28	32
CCS	54	57	27 3	39 2	52 2	65 1	78 2	91 5
Ports	36	40	44	48	52	56	60	64
CCS	10 49	11 83	13 18	14 55	15 92	17 29	18 67	20 05
Ports	68	72	76	80	84	88	92	96
CCS	21 43	22 82	24 21	25 61	27 00	28 40	29 80	31 20

For example, if the CCS for calls requiring voice processing in a call center is 1000, the number of ports required (from Table 4) is 36, which provides the lowest capacity greater than 1000 CCS.

Meridian Link HEVP processing is currently limited to a maximum of 48 voice ports, so traffic CCS figures of more than 48 ports implies a mix of voice port usage (probably including normal Meridian Mail mailbox use and IVR sessions in addition to Meridian Link HEVP).

Determining Meridian Mail port requirements for HEVP

- 1 Using the number of calls for the busiest hour of the year, estimate the number that will receive HEVP treatment. For example, if a call center receives 5000 calls, half of which require HEVP treatment, this number will be 2500.
- 2 Estimate the average holding time for the calls that will receive HEVP treatment for the busiest hour of the year.
- 3 Calculate the total traffic in CCS.

$$\text{CCS} = \text{calls receiving HEVP treatment} \times \text{holding time} / 100$$

For example, if a call center receives 2500 calls requiring HEVP treatment and the average holding time before the call transfers to an agent is 40 seconds, the CCS = $(2500 \times 40) / 100 = 1000$.
- 4 If your system intends to use Meridian Mail or the Meridian IVR feature, use Table 4 (earlier in this chapter) to determine the number of ports required.

Table 5
Worksheet for determining Meridian Mail ports for HEVP

1	Number of calls receiving HEVP treatment in the busiest hour	(a)
2	Average holding time	(b)
3	Traffic (CCS) = (a) x (b) / 100	(c)
4	From Table 4, find the number of ports required	
	Ports required	(d)
	Existing ports	(e)
	Additional ports = (d) - (e)	(f)

Engineering the Meridian Link and the AML

The Meridian 1 system uses the Meridian Link application to exchange messages with the host computer. These messages travel across the Meridian Link (link 1, between the host computer and the IPE Module or the Application Module) and the AML (link 0, between the Application Module or IPE Module and the Meridian 1 system). For every message on the AML, there is a corresponding message on the Meridian Link (which has additional messages if HEVP is used).

Determining the link data rate

CCR systems use only one link, the AML (link 0). Set the data rate of the AML to the default value of 19,200 bps.

In Meridian Link systems, both links should be set to the same baud rate. You should set the data rate for the Meridian Link (link 1) to the default value of 19,200 bps unless the default value cannot be used (for example, if the host computer or LAN server cannot operate at that rate). In that case, use the following procedure to estimate the lowest acceptable data rate for the link. Then set the data rate of the AML to the same value.

The following procedure involves estimating the busiest hour of the year. You may find unusual results. For example, during the busiest hour, agents may be exceptionally busy handling incoming calls and so the number of predictive or preview calls may be much lower than during non-busy hours. Note that the following procedure assumes that the effect of status change messages is negligible. You can eliminate unnecessary status change messages by setting up IAPGs.

For the busiest hour of the year:

- 1 Estimate the number of incoming calls terminating directly on ACD and non-ACD lines that will be assigned the AST attribute.

For example, in a Meridian 1 with 500 ACD agents and 100 Voice Response ports arranged as ACD associated sets, 11,000 calls might directly reach AST-configured ACD agents and sets during the busiest hour of the year.
- 2 Estimate the number of the above incoming calls that will be subsequently transferred to another agent under the control of the Meridian Link-based application.

For example, in the above example, 1500 out of 3,000 calls terminating on the above 100 voice ports may be subsequently transferred to live agents.

- 3** Estimate the number of outbound calls originated by ACD agents using a preview dialing application based on Meridian Link.

For example, a 20-agent group might generate 400 calls in the busiest hour.

- 4** Estimate the number of inbound calls to be routed to Meridian Mail ports for treatment by an application based on Meridian Link HEVP.

For example, if one third of all incoming calls received in a system handling 1,200 busy hour incoming calls, were routed for host-enhanced voice response, this number would be 400 calls.

- 5** Estimate the number of inbound calls to receive routing treatment by means of an application based on Meridian Link HER.

For example, if in a large call center, 50% of the 7,000 incoming calls in the busiest hour receive host routing, this number would be 3,500 calls.

- 6** Estimate the number of predictive dial calls to be originated on behalf of ACD or non-ACD agents using a predictive dialing application based on Meridian Link.

For example, 20 Autodialers might generate 1,000 calls in the busiest hour.

- 7** Estimate the number of calls to be transferred for a large HEVP application. For example, a 20-port HEVP application might result in 2,000 transfers in the busiest hour. (Normally, other activities such as conference initiation or agent ready/not-ready activation can be ignored.)

You are trying to estimate the busiest anticipated hour. In some instances, all agents might be handling just incoming calls during the busiest hour and thus the number of preview or predictive dial calls in the busiest hour would be smaller than expected in non-busy hours.

- 8** Add up the numbers calculated in steps 1 through 7 and select from Table 7 a data rate that handles at least that number of calls in the busy hour.

Table 6
Worksheet for determining the link data rate

1	Number of incoming calls terminating on AST lines	(a)	
2	Number of incoming calls from step 1 that will be transferred to another agent by the Meridian Link-based application	(b)	
3	Number of outgoing calls from ACD agents using preview dialing	(c)	
4	Number of incoming calls to be routed to Meridian Mail for HEVP treatment	(d)	
5	Number of incoming calls to receive HER treatment	(e)	
6	Number of predictive dial calls	(f)	
7	Number of calls to be transferred for a large HEVP application	(g)	
8	Add (a) through (g). Use Table 7 to select the appropriate link data rate	(h)	

Use this procedure *only* if the default data rate of 19,200 bps

cannot be used (for example, modems cannot support that speed).

Table 7
Link data rates and capacity

Maximum call load (calls/hour)	Link data rate
12,331–24,660	19,200
6,116–12,330	9,600
3,058–6,115	4,800
1,542–3,057	2,400
≤ 1,528	1,200

Table 7 provides the link data rate required to process various maximum call loads for a typical Meridian Link call.

If you take into account the additional messages generated by CCR, HER, or HEVP feature calls that use a script, you can still use Table 7 to determine the link data rate required to process your maximum call load. Because these feature calls tend to generate approximately 20% more messages than typical Meridian Link calls, multiply the number of CCR/HER/HEVP calls by 1.2.

For example, if a system handles the following busy hour calls:

Incoming ACD calls	3500
Subsequently transferred calls	500
Predictive-dialed calls	2000
Transferred calls	500
HER calls	$2000 \times 1.2 = 2400$
HEVP calls	$1000 \times 1.2 = 1200$
CCR calls	$1000 \times 1.2 = \underline{1200}$
TOTAL	11,300

The total number of busy hour calls is 11,300, which requires a 9600 bps connection to the host, as indicated in Table 7.

Rationale and assumptions

This section describes the rationale and assumptions used in deriving the tables and formulas for AML and real-time engineering.

Meridian Link and AML

The link data rate and capacity table (Table 7) is based on

- using an average of 38.5 bytes per message
- leaving a reserve of 30% of capacity to accommodate traffic peaks during the busy hour
- using an average of 10 messages per AML call
- engineering the AML for 70% of combined inbound and outbound messages to take into account duplex operation of the link

Estimating AML and Meridian Link capacity consists of calculating the number of calls and using a table lookup to find the data rate corresponding to the calculated number of AML or Meridian Link calls.

CCS, and holding time per line and per agent can vary significantly from site to site, and from application to application. You should use the formulas provided to recalculate the calling rate if the holding time of an application is significantly different from the underlying assumptions.

Relationship between AML and Meridian Link

One of the real-time functions of an Application Module is to convert AML protocol to X.25 protocol and vice versa. Other than local maintenance on the server, each message arriving from the Application Module will be converted and sent to the host. Similarly, each X.25 message from the host is translated to AML protocol and sent to the Meridian 1. There is a one-to-one correspondence between the input message and the output message of an Application Module. It is recommended that the data rate at both AML and Meridian Link should be the same. One calculation should yield the result for both links.

X.25 layer 3 and layer 2 overhead

Each network layer (layer 3) message communicated between a host and the Application Module needs to be supported by layer 2 overhead such as adding a header, a CRC error checking field, and a flag or flags to form a layer 2 frame. In addition, an RR (Receive Ready) message needs to be sent from one processor to the other communicating processor to ask whether previous messages have been received. RR frames can be sent at a varying rate from once every two messages to none, where an information frame may be sent instead of an RR frame after receiving a message.

When an average message length of 28 bytes is ready to be transmitted through the signaling link, the packet becomes 38.5 bytes long including the above mentioned overhead and an allocated RR message per message sent.

Peak load adjustment

The Meridian 1 CPU requires a margin of 30% over rated capacity to allow for traffic peaks in the busy hour. The AML and Meridian Link should have the same allowance because the extra processing power in the CPU needs to be matched by increased link capacity in order to accommodate peaks in the traffic. At a 19,200 bps data rate, for example, the recommended engineering load for the AML is 14.7 Kbps ($= 19.2/1.3$). This is the actual data rate used to calculate the message capacity of the link.

Uneven distribution of duplex link traffic

A full-duplex data link at 19,200 bps can carry traffic in one direction at 19,200 bps and traffic in the opposite direction also at 19,200 bps. The total message count obtained from Meridian Link is two-way traffic. By assuming a 70%-30% split on the direction of the traffic, the data link can be expected to handle 70% of the total two-way message traffic.